Analysing Outcome-Based Education: Efficacy of Infographics-Integrated Flipped Learning on Prospective Physical Education Teachers

SYNOPSIS

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Submitted to

AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN

Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD [now MoE]

Re-accredited with an 'A++' Grade by NAAC CGPA 3.65/4, Category I by UGC

Coimbatore - 641 043, Tamil Nadu, India

In Partial Fulfilment of the Requirement for the Degree of Doctor of Philosophy in Physical Education

March 2025

1/4/25

CHAPTER – I

INTRODUCTION

The higher education landscape in the 21st century has been fundamentally transformed by globalization, digitalization, and the demand for learner-centered, competency-based instruction **(OECD, 2018)**. Educational institutions worldwide are expected to equip learners with higher-order thinking, problem-solving, communication, and technological skills. In this evolving educational context, physical education and teacher training programs must align their pedagogical strategies with the dynamic needs of 21st-century Gen-Z learners to foster meaningful engagement and enhance learning outcomes **(Darling-Hammond et al., 2017)**.

The field of teacher education in India has undergone significant transformation, especially after the introduction of the National Education Policy (NEP) 2020, which advocates for competency-based education, multilingual learning, and the integration of technology in teaching and learning processes **(Ministry of Education, 2020)**. The Bachelor of Physical Education (B.P.Ed) program, a professional course aimed at preparing prospective physical education teachers, must now integrate modern pedagogical innovations to improve the quality and relevance of its curriculum. This shift calls for active learning strategies that move beyond passive knowledge acquisition to foster critical thinking, creativity, and conceptual clarity **(Sharma & Raval, 2021)**. In response to these developments, Outcome-Based Education (OBE) has emerged as a globally endorsed framework that emphasizes what students are expected to know, do, and value after completing a course or program. OBE ensures the alignment of instructional objectives, teaching-learning activities, and assessment strategies with clearly defined outcomes **(Spady, 1994)**. In India, the National Council for Teacher Education (NCTE) has outlined Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) for B.P.Ed. programs to promote consistent quality and outcome attainment in teacher education **(NCTE, 2015)**. These structured outcomes provide a benchmark for course development and assessment, thereby making learning more transparent and measurable.

Despite the importance of OBE, achieving its goals requires innovative instructional strategies that are both engaging and accessible. One such strategy is flipped learning, a model in which students engage with instructional content—often in the form of videos, readings, visual modules—prior to class, and use classroom time for deeper engagement, discussion, and problem-solving **(Bishop & Verleger, 2013)**. In the context of physical education and sports sciences, flipped learning has shown promise in enhancing student

participation, motivation, and conceptual understanding **(McEvoy et al., 2015)**. However, for flipped learning to be effective, the design and presentation of pre-class materials are crucial. This is where educational infographics play a vital role. Infographics are visual tools that simplify complex information, making it more digestible and memorable for learners **(Smiciklas, 2012)**. In content-heavy subjects such as sports nutrition, which often involve technical terminology and biochemical processes, infographics can support learners in grasping core concepts with clarity. Furthermore, integrating bilingual infographics (Tamil and English) addresses regional linguistic diversity, fostering inclusivity and improving comprehension among learners with varying language proficiencies **(Praveen & Deepa, 2022)**.

The Applied Sports Nutrition course designed in this study is structured around OBE principles, with specific Course Outcomes (COs) mapped to POs and PSOs. The course is delivered through an infographics-integrated flipped learning model, supported by the ADDIE instructional design framework. The model emphasizes active learner engagement, visual content processing, and critical thinking during in-class activities. In addition, students' learning styles, as categorized by the VARK model **(Fleming & Mills, 1992)**, play an important role in how they engage with and benefit from different instructional approaches. Understanding individual preferences in acquiring and processing information allows for more personalized and effective teaching methods. Moreover, evaluating learners' perceptions of the flipped learning approach in comparison to traditional lecture-based teaching helps in refining instructional practices to suit their needs. In this context, the present study seeks to evaluate the efficacy of an infographics-integrated flipped learning approach within an OBE framework, with a focus on cognitive development, learner engagement, and course attainment. It also explores how this pedagogical strategy enhances critical thinking skills, supports bilingual understanding, and aligns with NEP 2020's goals of holistic and inclusive education.

RESEARCH GAPS

Identified Issue: Existing sports nutrition concepts are presented through a monolingual infographic approach in educational settings.

Gap - 1: There is a notable knowledge gap on the integration of applied sports nutrition concepts with bilingual infographics (Regional Language: Tamil and English) and their impact on improving students' cognitive skills and application of these concepts.

Significance: This study addresses this gap by examining the efficacy of bilingual infographics in enhancing students' understanding and application of sports nutrition

concepts. Findings from this study could improve educational strategies and promote better knowledge retention and application in sports nutrition.

Identified Issue: Existing studies focus predominantly on academic achievement (e.g., grades, test scores) as the primary measure of learning outcomes.

Gap - 2: There is limited research exposed on the OBE-based assessment approach for quantitative assessment of course attainment, particularly in mapping CO, PO, and PSO to predefined target levels.

Significance: This gap highlights the need for research that systematically evaluates learning outcome attainment through a structured OBE-based assessment approach, ensuring a more comprehensive measure of cognitive skill development beyond traditional academic performance indicators. This study examines the development of higher-order cognitive skills by mapping PO, PSO, and CO to Bloom's Taxonomy to evaluate how well achieved outcomes match target levels.

Identified Issue: Courses in Bachelor of Physical Education (B.P.Ed) programs are typically constructed based on Program Outcomes (PO) and Program Specific Outcomes (PSO) with predefined course outcomes. However, the combined impact of course construction, learner-centered instructional methods, learning approach, and outcomes assessment using OBE remains underexplored.

Gap - 3: There is a lack of research on the combined impact of:

- ✓ Course Construction – Developing courses based on B.P.Ed Programme PO and PSO with predefined course outcomes.
- ✓ Learner–Centered Instructional Method – Application of flipped learning using bilingual infographics based on the ADDIE framework.
- ✓ Learning Process – Enhancing students' understanding and cognitive skill development through a learner-centered approach.
- ✓ Assessment – Measuring learning outcome attainment through formative and summative assessments at different cognitive levels based on Bloom's Taxonomy within an Outcome-Based Education (OBE) framework.

Significance: This study evaluates the effectiveness of a learner-centered flipped approach with ADDIE-based bilingual sports nutrition infographics in enhancing cognitive skills. It assesses learning outcomes using an OBE-based process aligned with Bloom's Taxonomy to improve instructional strategies and active learning.

RESEARCH OBJECTIVES

Based on the identified research gap and research questions framed, the following objectives were derived:

Primary Objective

1. To evaluate the effectiveness of Infographics-Integrated Flipped Learning (IIFL) in facilitating Applied Sports Nutrition Learning Outcomes, Course Attainment and Gap Analysis within the OBE framework.

Secondary Objectives

2. To design an Applied Sports Nutrition short-term course with predefined Course Outcomes (CO) based on Revised Bloom's Taxonomy, aligned with the B.P.Ed Program Outcomes (PO) and Program Specific Outcomes (PSO).
3. To create bilingual Infographic-based instructional E-modules for Applied Sports Nutrition, adaptable to different Learning Styles.

HYPOTHESES

All the following null hypotheses (H_0) were formulated and subjected to statistical testing at the 0.05 level of significance to determine their acceptance or rejection.

Hypothesis – 1

- **H_{01}(a)** There is no significant difference in the mean difference in Previous Sports Nutrition Knowledge scores among participants based on VARK Learning Styles (Visual, Auditory, Read/Write, Kinesthetic) and Academic Background (SNK & NSNK) prior to stratified randomization.
- **H_{01}(b)** There is no significant difference mean difference in Previous Sports Nutrition Knowledge between the Experimental Group (Infographics-Integrated Flipped Learning: IIFL) and the Active Control Group (Traditional Lecture-Based Teaching: TLBT) after stratified randomization.

Hypothesis – 2

- **H_{02}** There is no significant effect of the Infographic-Integrated Flipped Learning (EG-IIFL) compared to the Traditional Lecture-Based Teaching (ACG-TLBT) on Critical Thinking (CT) and its sub-constructs.

Hypothesis – 3

- **H_{03}** There is no significant mean difference in learners' perception and its sub-constructs between the EG-IIFL and ACG-TLBT groups.

Hypothesis – 4

- **H_{04}(a)** There is no significant mean difference in Learning Progress (LP), Learning Efficiency (LE), and Learning Outcomes (LO) between the EG-IIFL and the ACG-TLBT in the OBE-framework Applied Sports Nutrition course.
- **H_{04}(b)** There is no significant mean difference in Learning Progress (LP), Learning Efficiency (LE), and Learning Outcomes (LO) among learners with four different VARK learning styles.

Hypothesis – 5

- **H_{05}(a)** There is no significant mean difference in Learning Progress (LP), Learning Efficiency (LE), and Learning Outcome (LO) across Revised Bloom's Taxonomy levels (Remember, Understand, Apply, Analye, Evaluate, Create) between IIFL and TLBT.
- **H_{05}(b)** There is no significant Influence of Revised Bloom's cognitive dimensions on learners' Learning Outcomes.

Hypothesis – 6

- **H_{06}(a)** There is no significant mean difference in Course Outcome (CO1–CO6) scores between the EG-IIFL and the ACG-TLBT groups.

The following hypotheses framed in this study are **Directional Descriptive Research Hypotheses**.

Hypotheses – 7: Course Outcome (CO) Attainment Analysis

- **H_7(a) — Overall CO Attainment:** The overall Course Outcome (CO) attainment and percentage of prospective physical education teachers instructed through EG-IIFL will be higher than that of those instructed through ACG-TLBT.
- **H_7(b) — Formative Assessment Threshold Attainment (≥60%):** A higher proportion of students in the EG-IIFL group will achieve the OBE threshold attainment level (≥60%) in formative assessments compared to the ACG-TLBT group.
- **H_7(c) — Summative Assessment Threshold Attainment (≥60%):** A higher proportion of students in the EG-IIFL group will attain the ≥60% threshold in summative assessments compared to the ACG-TLBT group.
- **H_7(d) — CO Attainment Level Distribution:** The EG-IIFL group will exhibit a higher proportion of COs at the High attainment level (Level 3) and a lower proportion at the Low attainment level (Level 1) compared to the ACG-TLBT group across CO1–CO6.
- **H_7(e) — Higher-Order Level Performance (Bloom's L4–L6):** The EG-IIFL group will achieve higher percentage scores in Analyze, Evaluate, and Create compared to the ACG-TLBT group.

Hypotheses – 8: COs–POs–PSOs Mapping and Gap Analysis

- **H_8(a) — COs–POs–PSOs Attainment Mapping Level:** The EG-IIFL group will demonstrate higher CO–PO–PSO mapping attainment levels (PO1–PO10 and PSO1–PSO3) compared to the ACG-TLBT group.
- **H_8(b) — Gap Analysis of COs–POs–PSOs Attainment:** The COs–POs–PSOs attainment gap score (Gap = Target Attainment Level − Actual Attainment Level) will be smaller for the EG-IIFL group than for the ACG-TLBT group across all POs (PO1–PO10) and PSOs (PSO1–PSO3).

DELIMITATIONS

1. **Geographical Boundary:** The study is geographically limited to Avinashilingam Institute, focusing only on 76 - B.P.Ed. Female prospective physical education teachers
2. **Group Allocation:** Samples were randomly assigned to two groups (active control-TLBT and experimental-IIFL), ensuring a balance stratum based on Prior knowledge of Sports Nutrition, learning style, and Previous Sports Nutrition knowledge Score.
3. **Teaching & Learning Approach:** The study analyses teacher-centric (Traditional Lecture-Based Teaching) and student-centric (Infographics-Integrated Flipped Learning) instructional methods over a six-week intervention period with three sessions per week.
4. **Assessment & Outcome Criteria:**
    - Outcome Measures: OBE-Framework - Learning Outcomes (dependent variable)
    - Learning was assessed through formative (40%) and summative (60%) evaluations, aligned with Bloom's Taxonomy.
    - The direct attainment threshold for Course Outcomes (CO) was set at 60%.
    - The 40:60 formative-to-summative assessment ratio follows NEP 2020 (India – National Education Policy 2020) guidelines.

LIMITATIONS

1. The study does not incorporate Learning Management Systems (LMS) to track student engagement, which may impact learning outcome attainment.
2. Findings are limited to Avinashilingam Institute and may not be generalizable to other institutions or regions.
3. Long-term knowledge retention and skill development beyond the intervention were not assessed.
4. Psychological factors like motivation, emotional intelligence, and mood were not considered.
5. The impact of technological proficiency, language fluency, and digital literacy or internet access challenges was not explored.

CHAPTER - II

REVIEW OF RELATED LITERATURE

The integration of Outcome-Based Education (OBE) and flipped learning has gained significant attention in higher education, particularly in skill-based disciplines like physical education. Research indicates that flipped learning enhances learner engagement, critical thinking, and knowledge retention by shifting passive content delivery to pre-class activities, allowing in-class sessions to focus on application and deeper discussions **(Bishop & Verleger, 2013)**. In the context of sports education, incorporating infographics-integrated flipped learning provides a structured yet flexible framework that aligns with OBE principles, enabling students to achieve well-defined Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) **(Tang et al., 2020)**.

Furthermore, the VARK learning model **(Fleming & Mills, 1992)** has been extensively used to categorize learners based on their preferred sensory modalities—Visual, Auditory, Read/Write, and Kinesthetic—allowing educators to tailor instructional strategies accordingly. Studies have shown that Gen Z learners predominantly prefer visual learning methods**,** making infographics a highly effective pedagogical tool **(Moore et al., 2022).** Additionally, the ADDIE instructional model (Analyze, Design, Develop, Implement, Evaluate) remains a robust framework for designing learner-centered interventions, as it allows for iterative improvements and alignment with learning objectives **(Branch, 2009)**.

The review concluded by identifying key research gaps that justify the present investigation. These include: (1) a lack of bilingual infographic integration in teaching applied sports nutrition; (2) limited research on OBE-based outcome mapping and cognitive assessment in physical education; and (3) a scarcity of studies combining course construction, learner-centered pedagogy, bilingual visual content, and structured assessments in one comprehensive instructional model. By addressing these gaps, the current study aims to contribute to evidence-based practices in physical education and enhance instructional design through innovative, inclusive, and outcome-aligned strategies.

The present study investigates the effectiveness of a bilingual infographics-integrated flipped learning approach in enhancing cognitive outcomes in an Applied Sports Nutrition course among prospective physical education teachers within the framework of Outcome-Based Education (OBE). The findings reinforce the necessity of infographics-integrated flipped learning within OBE, particularly in applied disciplines like sports nutrition education, where practical application, critical analysis, and adaptive learning are key to student success.

CHAPTER - III

METHODOLOGY

Sampling & Research Design: This study adopts a **Quasi-experimental post-test control group design** to examine the efficacy of Infographics-Integrated Flipped Learning (IIFL) compared to Traditional Lecture-Based Teaching (TLBT) among 76 B.P.Ed female prospective physical education teachers at Avinashilingam Institute, Tamil Nadu, India. The study follows a **Stratified random sampling technique**, where learners were categorized based on prior knowledge in sports nutrition, VARK learning styles (Visual, Auditory, Read/Write, Kinesthetic), and previous sports nutrition knowledge score to ensure diversity in instructional impact. After the three-stage stratification process, participants were randomly assigned using the lottery method into the Experimental Group (IIFL), n=38, and Active Control Group (TLBT), n=38.

Research Variables:

Independent Variable: Pedagogical Approach

- The instructional method was the key independent variable with two levels:
    - **Experimental Group**: Infographics-Integrated Flipped Learning (IIFL).
    - **Control Group**: Traditional Lecture-Based Teaching (TLBT).
- **Learners' Perception** (measured through a self-made questionnaire based on Bloom's Taxonomy) was also considered an independent variable, reflecting engagement and response to instruction.

Dependent Variable: Course Attainment (Cognitive Outcomes)

- Learning outcomes were assessed through:
    - **Formative assessments** (weekly MCQs and assignments).
    - **Summative assessment** (post-test MCQs).
- All assessments aligned with Course Outcomes (COs) under the OBE framework.

Intervening Variable: Critical Thinking

- Represents learners' ability to analyze, evaluate, and apply sports nutrition concepts in practical and assessment contexts.

Confounding Variables

- **Learning Style**: Categorized using the VARK model (Visual, Auditory, Read/Write, Kinesthetic), influencing engagement with instructional content.
- **Prior Knowledge in Sports Nutrition**: Controlled through stratification to minimize its impact on learning outcomes.

Controlled Variables

- **Course Content**: Standardized six-week Applied Sports Nutrition course for both groups.
- **Duration**: Equal instructional time (three sessions per week).
- **Language Medium**: Bilingual instruction (Tamil and English) for consistency.
- **Course Instructor**: The researcher handled both groups.
- **Instructional Framework**: The ADDIE model was applied uniformly across both instructional methods.

The study targeted a finite and specific population of seventy-six (N=76) female prospective physical education teachers (aged 20–28 years) enrolled in the two-year B.P.Ed programme at Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, which follows NCTE guidelines within an Outcome-Based Education (OBE) framework. Institutional approval was obtained, and all participants provided informed consent, ensuring ethical conduct and voluntary participation. A probability-based stratified random sampling design was employed to ensure equal representation and minimise sampling error. The heterogeneous population was stratified based on three criteria: academic background (sports nutrition knowledge—SNK and non-sports nutrition knowledge—NSNK), learning styles (VARK model), and prior knowledge level in sports nutrition. Following stratification, participants were randomly assigned using the lottery method into two equal groups: Experimental Group (Infographics-Integrated Flipped Learning, n=38) and Active Control Group (Traditional Lecture-Based Teaching, n=38), ensuring balanced representation across all strata and enhancing internal validity for comparative analysis.

The study included multiple variables to evaluate the effectiveness of instructional approaches within the OBE framework. The independent variable was the pedagogical approach (IIFL vs. TLBT), while the dependent variable was learning outcome (course attainment), measured through formative (weekly MCQs and assignments) and summative (post-test MCQs) assessments aligned with Bloom's Taxonomy. Confounding variables such as learning style (VARK) and prior knowledge were controlled through stratification, while critical thinking acted as an intervening variable and learners' perception as a latent variable assessed through a structured questionnaire. Controlled variables included course content (six-week sports nutrition course), instructor consistency, bilingual instruction (Tamil–English), ADDIE instructional framework, and uniform assessment tools. The course was designed with six Course Outcomes (COs) mapped to Programme Outcomes (POs) and Programme Specific Outcomes (PSOs). Assessment comprised 40% formative and 60% summative evaluation, with a 60% attainment benchmark and categorisation into high, medium, and low levels. Gap analysis and CO–PO–PSO mapping were used to evaluate outcome alignment, ensuring that performance differences were attributable to the instructional method while also serving as a diagnostic and quality enhancement mechanism.

CHAPTER - IV

ANALYSIS AND DISCUSSION OF FINDINGS

DISCUSSION AND FINDINGS

The study findings revealed that the Infographics-Integrated Flipped Learning (IIFL) approach was significantly more effective than Traditional Lecture-Based Teaching (TLBT) across all measured outcomes. The EG-IIFL group demonstrated superior performance in critical thinking (η^2=.719, p<.001), learner perception (d=5.46), learning progress, learning efficiency, and overall learning outcome (d=9.57) — all with very large effect sizes. Across Bloom's Taxonomy levels, IIFL's advantage was most pronounced at higher-order cognitive levels (Analyse, Evaluate, Create), while Application showed no significant difference between groups. Stepwise regression confirmed that all six Bloom's dimensions significantly predicted Learning Outcome, with Evaluation (β=.278) as the strongest predictor, and the final model explaining 97.3% of variance (R^2=.973).

Within the OBE framework, the EG-IIFL group achieved an overall Course Outcome attainment of 2.93 out of 3, compared to 2.67 for the ACG-TLBT group, with a formative threshold attainment average of 78.95% versus 65.79%. The IIFL group attained High (Level 3) attainment in CO1–CO5, while the control group fell to Low (Level 1) attainment at the HOTS-level outcomes (CO5 and CO6), indicating an OBE failure at higher cognitive demands. CO–PO–PSO mapping attainment was consistently higher for IIFL across all 13 programme outcomes, with an average gap score of 0.21 compared to 0.59 for TLBT — meaning the control group's attainment gap was 2.81 times larger. These findings collectively confirm that the ADDIE-based, bilingual infographic-integrated flipped learning model is a robust, evidence-based instructional framework that significantly enhances conceptual understanding, higher-order thinking, and measurable outcome attainment among prospective Physical Education teachers within the OBE framework.

CHAPTER - V

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

This study evaluated the effectiveness of Infographics-Integrated Flipped Learning (IIFL) compared to Traditional Lecture-Based Teaching (TLBT) within an Outcome-Based Education (OBE) framework for an Applied Sports Nutrition course. The findings strongly support the superiority of IIFL across multiple teaching and learning dimensions. Stratified randomization ensured equivalent baseline knowledge across groups, validating the study's internal reliability. The results showed that IIFL significantly enhanced cognitive skills, particularly analytical reasoning, reflective learning, and critical thinking, emphasizing the role of bilingual infographics and active learning strategies in fostering deeper engagement. Learner perceptions also favored IIFL, with students reporting higher satisfaction due to structured learning, active engagement, and motivational support. Assessment outcomes further confirmed the efficacy of the intervention—weekly formative scores reflected consistent progress, while summative assessments demonstrated superior long-term retention and application of knowledge in the experimental group. Notably, IIFL led to higher attainment in Course Outcomes (COs), Programme Outcomes (POs), and Programme Specific Outcomes (PSOs), particularly in areas such as knowledge application, analytical decision-making, and performance planning—essential skills for sports nutrition and physical education training. The flipped learning model also proved effective in mastering higher-order outcomes, such as critical evaluation of food labels and nutritional periodization strategies.

Overall, this study underscores the pedagogical benefits of integrating infographics into a flipped learning environment, affirming its potential as an innovative, learner-centered approach in teacher education while aligning with the principles of Outcome-Based Education (OBE).

CONCLUSION

This study comprehensively examined the effectiveness of Infographics-Integrated Flipped Learning (IIFL) in enhancing learning outcomes within an Outcome-Based Education (OBE) framework for prospective physical education teachers. The findings revealed that integrating bilingual infographics into a flipped instructional approach significantly improved learner engagement, content comprehension, and higher-order thinking skills. Compared to Traditional Lecture-Based Teaching (TLBT), IIFL fostered greater analytical reasoning, reflective learning, and critical thinking, demonstrating its pedagogical value in promoting deep learning and real-world application in Applied Sports

Nutrition. The intervention was carefully designed to align with Course Outcomes (COs), Programme Outcomes (POs), and Programme Specific Outcomes (PSOs), ensuring relevance to the B.P.Ed curriculum prescribed by NCTE.

The results further highlighted those learners in the IIFL group consistently outperformed their TLBT counterparts in both formative and summative assessments, reinforcing the benefits of active learning, self-paced pre-class exposure, and interactive in-class applications. The use of bilingual (Tamil-English) infographics was particularly effective in supporting learners with varied prior knowledge levels and diverse learning styles, thereby bridging cognitive gaps and enhancing conceptual clarity. Additionally, learners in the IIFL model reported higher levels of engagement, motivation, and structured knowledge organization, emphasizing the effectiveness of visually enriched, technology-driven instruction. The study's gap analysis indicated a notable reduction in the proportion of low-achieving learners and an increase in those achieving medium and high mastery levels, further validating the scalability and inclusivity of the approach.

Infographics-Integrated Flipped Learning (IIFL) within an OBE framework is significantly more effective than Traditional Lecture-Based Teaching (TLBT) in enhancing Applied Sports Nutrition learning outcomes among prospective Physical Education teachers. Multi-level evidence across all variables — critical thinking, learner perception, learning progress, learning efficiency, learning outcome, course attainment, Bloom's cognitive performance, and CO–PO–PSO gap analysis — consistently confirms IIFL's superiority.

In conclusion, this research establishes Infographics-Integrated Flipped Learning (IIFL) as a transformative and evidence-based instructional model for teacher education. By aligning with 21st-century educational demands, it effectively enhances content mastery, critical thinking, digital literacy, and interdisciplinary application, ensuring the holistic development of prospective physical education teachers. The findings strongly support the wider adoption of IIFL in multilingual, multicultural educational contexts, particularly in domains where conceptual understanding and applied knowledge are critical. This study provides a robust foundation for integrating visual and flipped pedagogical strategies into OBE-driven curriculum reforms, paving the way for more student-centered, inclusive, and effective learning environments. These priorities are also reflected in the United Nations Sustainable Development Goal 4 (SDG 4), which stresses inclusive and equitable quality education that promotes lifelong learning (UNESCO, 2017).

RECOMMENDATIONS AND IMPLICATIONS

- **Integrate IIFL in Teacher Education**: Adopt Infographics-Integrated Flipped Learning (IIFL) in B.P.Ed. and related programs to enhance engagement, clarity, and higher-order thinking.
- **Use AI for Personalized Learning**: Implement AI-driven quizzes, chatbot tutors, and adaptive feedback systems for individualized learning.
- **Develop Bilingual Content**: Promote Tamil-English infographics content for better accessibility and inclusive education.
- **Create a Digital Repository**: Establish an open-access platform for OBE-aligned infographics, videos, and assessments.
- **Upskill Faculty in EdTech**: Train educators in infographic creation, AI tools, and flipped learning strategies.
- **Differentiate Instruction Using VARK**: Tailor content to visual, auditory, reading, and kinesthetic learners for better engagement.
- **Focus on Higher-Order Learning**: Use visual tools to improve analysis, decision-making, and problem-solving skills.
- **Encourage Self-Directed Learning**: Implement structured journals, concept maps, and self-assessment rubrics in flipped lessons.
- **Promote Active Learning Pedagogies**: Shift from lecture-based methods to participatory, inclusive teaching approaches.
- **Use AI for Outcome Tracking**: Leverage data analytics to monitor CO, PO, and PSO attainment and inform curriculum refinement.
- **Introduce Collaborative Infographic Projects**: Foster teamwork and deep learning by integrating infographic-based assignments.
- **Expand IIFL to Online and In-Service Training**: Apply flipped learning in distance education, MOOCs, and teacher training programs.
- **Encourage Further Research in India**: Investigate the impact of flipped and visual pedagogies across different learner populations.
- **Integrate OBE in LMS Platforms**: Configure Moodle, Google Classroom, or Canvas to map lessons, track attainment, and generate reports for accreditation.

REFERENCE

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. ASEE National Conference Proceedings, 30(9), 1–18.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2017). Implications for educational practice of the science of learning and development. Applied Developmental Science, 24(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

McEvoy, E., MacPhail, A., & Enright, E. (2015). Physical education teacher educators' views about a flipped learning pedagogy in a teacher education institution: An exploratory case study. Teaching and Teacher Education, 55, 44–53. https://doi.org/10.1016/j.tate.2015.12.002

Ministry of Education, Government of India. (2020). National Education Policy 2020. https://www.education.gov.in/

NCTE. (2015). Norms and Standards for Bachelor of Physical Education (B.P.Ed.). National Council for Teacher Education.

OECD. (2018). The future of education and skills: Education 2030. Organisation for Economic Co-operation and Development. https://www.oecd.org/education/2030-project/

Praveen, C., & Deepa, K. (2022). Enhancing bilingual instructional strategies in teacher education through infographic-based learning. International Journal of Education and Development using ICT, 18(2), 115–129.

Smiciklas, M. (2012). The power of infographics: Using pictures to communicate and connect with your audiences. Que Publishing.

Spady, W. G. (1994). Outcome-based education: Critical issues and answers. American Association of School Administrators.

Sharma, R., & Raval, R. (2021). Competency-based learning for future-ready physical education teachers. Journal of Educational Technology and Innovation, 5(1), 29–36.

UNESCO. (2015). Education 2030: Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4. UNESCO Publishing.

Lal, A. (2018). Implementation of outcome-based education in physical education programmes in India. International Journal of Physical Education, Sports and Health, 5(3), 01–04.